

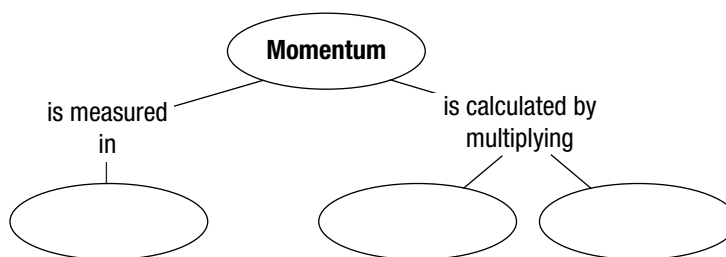
Chapter 12 Forces and Motion

Section 12.3 Newton's Third Law of Motion and Momentum**(pages 372–377)**

This section describes action-reaction forces and how the momentum of objects is determined.

Reading Strategy (page 372)

Summarizing As you read about momentum in this section, complete the concept map to organize what you learn. For more information on this Reading Strategy, see the **Reading and Study Skills** in the **Skills and Reference Handbook** at the end of your textbook.

**Newton's Third Law (page 373)**

1. According to Newton's third law of motion, what happens whenever one object exerts a force on a second object? _____
2. The equal and opposite forces described by Newton's third law are called _____ and _____ forces.
3. Circle the letters that identify each sentence that is true about action-reaction forces.
 - a. Newton's second law describes action-reaction forces.
 - b. Forces always exist in pairs.
 - c. Action-reaction forces never cancel.
 - d. All action-reaction forces produce motion.
4. Is the following statement true or false? Action-reaction forces do not cancel each other because the action force is always greater than the reaction force. _____

Momentum (pages 374–375)

5. Circle the letter of each factor that affects the momentum of a moving object.
 - a. mass
 - b. volume
 - c. shape
 - d. velocity
6. If two identical objects are moving at different velocities, the object that is moving faster will have _____ momentum.

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7. Your in-line skates are sitting in a box on a shelf in the closet. What is their momentum? _____
8. Is the following sentence true or false? An object with a small mass can have a large momentum if the object is traveling at a high speed. _____
9. Write the momentum formula, including the correct units.

10. Circle the letter of the object that has the greatest momentum.
 - a. a 700-gram bird flying at a velocity of 2.5 m/s
 - b. a 1000-kilogram car traveling at 5 m/s
 - c. a 40-kilogram shopping cart rolling along at 0.5 m/s
 - d. a 300-kilogram roller coaster car traveling at 25 m/s

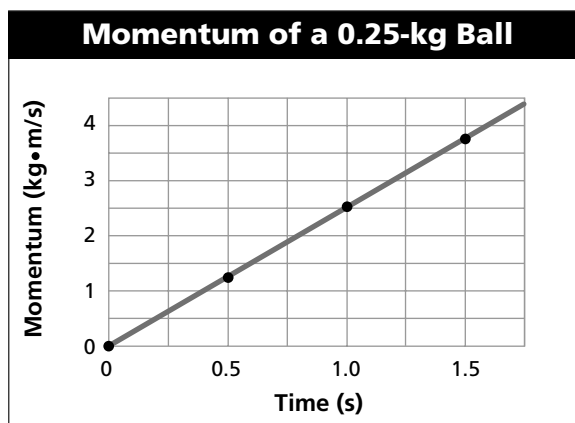
Conservation of Momentum (pages 376–377)

11. What does conservation of momentum mean? _____

12. Is the following sentence true or false? Objects within a closed system can exert forces on one another, but other objects and forces cannot leave or enter the system. _____
13. According to the law of conservation of momentum, what happens to the total momentum of a system if no net force acts on the system?

14. Is the following sentence true or false? In a closed system with two objects, the loss of momentum of one object equals the gain in momentum of the other object. _____

For questions 15 and 16, refer to the graph below.



15. The momentum of the ball at one second is _____.
16. What is the speed of the ball at 0.5 seconds? Show your calculation. *Hint:* Solve the momentum formula for velocity.